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The green side of social innovation: Using sustainable development goals to classify environmental impacts of rural grassroots initiatives

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Abstract

Social innovations are grassroots processes aiming to achieve impacts beyond an individual level and towards a broader societal good. The environmental dimension of impacts refers to any direct change to the environment resulting from social innovation activities, products, or services, which are not addressed by pre-existing systems. In this paper, we determine the role of social innovation in addressing environmental impacts by analyzing a database of social innovation examples in European and circum-Mediterranean rural areas, compiled within the H2020 Project SIMRA. We conceptualize the overall aim of environmentally-focused social innovation initiatives as furthering the sustainable development of their territories. To address the environmental impacts of initiatives in a structured way, we use the Sustainable Development Goals (SDG) classification, to describe social innovation environmental impacts in relation to specific targets. We analyzed 238 initiatives from the SIMRA catalog and associated initiative websites to identify and classify their direct environmental impacts. Our results indicate that 68% of the cases have at least one direct environmental impact that aligns with a SDG target. The most common impacts are related to sustainable natural resource management (SDGs target 12.2), sustainable food production systems (2.4), and equal access to land (2.3). This SDG-based classification proved to be a useful analytical tool for categorizing internationally policy-relevant environmental impacts of social innovations.

KEYWORDS

agriculture, bottom-up approaches, ecological transition, forestry, rural development, sustainable resource management

1 | INTRODUCTION AND LITERATURE REVIEW

1.1 | Introduction

The impact of human behavior on the environment has surged at the planetary scale over the past half century. Natural cycles have been drastically disrupted by overpopulation, pollution, fossil fuels consumption, land-use changes, and deforestation, among other causes (Steffen et al., 2018). Such changes have triggered cascading effects on global weather patterns and ecosystems including climate change, biodiversity loss, soil, and land degradation, and pollution of water and air (Cardinale et al., 2012; NASA, 2020). Moreover, impacts from climate change and environmental degradation extend well beyond direct planetary ecosystems shifts, having detrimental effects on human health, food supply, energy and renewable resources stocks, and societal stability.

If humanity wishes to stop exceeding planetary boundaries, major transformations are needed in the way we interact with our surrounding environment. Several programs and strategies have been developed at international levels to reverse the environmental impacts of climate change and to transform current societal and economic patterns. These include (i) binding international agreements to stimulate alternative human consumption models such as The Paris Agreement (United Nations, 2015a), EU Bioeconomy Strategy (European Commission, 2018), and the Recast of the Renewable Energies Directive (European Parliament, 2016), and (ii) internationally agreed indicator frameworks paving the way for a new blueprint for human society. The latter includes the eight Millennium Development Goals (United Nations, 2013) and the follow-up program of the 17 sustainable development goals (SDG) (United Nations, 2015b), which addresses the global environmental, economic, and social challenges humanity faces, in a holistic way. The SDGs are designed as social contracts “between the world’s leaders and the people” for a new “shared vision of humanity” (UN News, 2015). They aim at activating and supporting global, national, and local, initiatives and programs which focus on achieving one or several goals by 2030.

While regulatory and restrictive approaches are important policy instruments to halt human-induced environmental degradation and rebalance human-nature interactions, they might fail to deliver their expected objectives due to inter alia political resistance and/or the need for large up-front investments towards control and patrolling (e.g., field officers). Additionally, they have been criticized due to their inability to mediate “the dynamic behaviour of social-ecological systems” (Olsson & Galaz, 2012). All over the world, groups of people, communities, and citizens have recognized the need for cooperation, coordination, and alliances to tackle both global and local environmental challenges.

The discrepancy between governance systems at local and global levels has been addressed by both ecological resilience and social-ecological literature (Folke et al., 2007; MacKinnon & Derickson, 2013), which indicates the need to create new governance systems which function at multiple scales (global to local) and spheres (biophysical to human well-being; Olsson & Galaz, 2012). In this sense, environmental social innovations play an important role in complementing the

limitation of top-down normative frameworks (Green et al., 2014). New collective strategies and networks create discussion platforms where shared decisions are taken to change paradigms and for (progressively) achieving societal transformations and ecological transitions toward common wellbeing (e.g., Slow Food, a global and grassroots organization created in 1989 to preserve food cultures and traditional farming production models). These governance models are defined in the literature as social innovations (SI), as they imply new collaborative interactions involving community members, private actors, and public bodies (Moulaert et al., 2013; Neumeier, 2012; Polman et al., 2017). SI is a scientific construct generating important academic debates (e.g., see in Edwards-Schachter & Wallace, 2017; Pol & Ville, 2009). It is also of increasing relevance in the policy environment, thanks to its inherent flexibility and breadth. SI encapsulates a wide variety of examples (e.g., from agriculture to forestry, from urban to rural networks, from associations to public-private partnerships), all aiming at tackling community problems through changed social and economic behaviors. While studies in the literature have identified how social and environmental impacts in SI are tightly interlinked (Baker & Mehmood, 2015), to the best of our knowledge no studies have performed a systematized review of the environmental impacts of SI initiatives.

To fill this gap, this study determines the role of SI in addressing environmental impacts. We focus our analysis on a selection of local and international SI initiatives in European and circum-Mediterranean rural areas, compiled by the EU Horizon 2020 project, Social Innovation in Marginalized Rural Areas (SIMRA). The SIMRA project provided an advanced understanding of the mechanisms behind SI development in marginalized rural areas, in the fields of agriculture, forestry and rural development (Zenodo, 2019). Project outcomes include: a definition of SI tailored to marginalized rural areas (Polman et al., 2017), a detailed set of tools to evaluate SI and its impacts (Kluvankova et al., 2021; Secco et al., 2020), One of the largest available database of SI examples (Valero & Bryce, 2020).

Studying environmental impacts of SI in rural communities is particularly relevant as rural societies are often strongly connected with their surrounding environment. Thus, we expect to identify a large share of rural SI initiatives operating through human-environment interactions. To assess environmental impacts of SI in a structured way, we use the SDG classification, which permits the description of SI environmental impacts through a series of disaggregated policy targets. Our specific research questions are: (a) what are the environmental impacts of rural SI initiatives? and (b) to what extent does SI contribute to a green transition? To address these questions, we explore in which fields different SI initiatives are aligned with environmental policy objectives and therefore support SDGs environmental targets.

1.2 | Literature review

1.2.1 | Social Innovation

In this study, we conceptualize SI following the definition developed by Polman et al. (2017), stating that SI is a “reconfiguration of social

practices in response to societal challenges, which seeks to enhance outcomes on societal well-being and necessarily includes the engagement of civil society actors.” Although we acknowledge that many alternative SI definitions exist (e.g., Edwards-Schachter & Wallace, 2017; Moulaert et al., 2013; Neumeier, 2012; Pol & Ville, 2009), we follow Polman et al. (2017)’s definition for three main reasons. First, it stresses the centrality of human agency in SI processes, as the requisite catalyst to initiate changes in attitudes, behaviors, and governance. Agency is regarded as the “ability to recognise needs, exploit contextual social, normative and financial resources and to engage civil society through collective actions” (Dalla Torre et al., 2020). Through collective actions, agency engages people in SI processes promoting new ecological, social, or institutional practices (Folke et al., 2010). At the local level, this differs from the transformative power of social innovation, proposed by Haxeltine et al. (2017). Transformative SI indicates the ability of SI processes to “alter and/or replace dominant institutions.” In the rural context, the transformative power of SI models is often limited, and tend to coexist with institutionalized and traditional schemes (e.g., environmental friendly tourism initiatives vis-a-vis traditional tourism models). Nonetheless there exist some cases of transformative SI models in rural areas active at both local and global levels (e.g., Slow Food; Avelino et al., 2019). The opportunity for socio-ecological systems to be transformed in ways that favor sustainable outcomes depends to an extent on their adaptive capacity as described by Folke et al. (2010). Such capacity is underpinned by a “learning by doing” approach which can be implemented where social networks are flexible and can reconfigure in response to challenges and new information.

Second, Polman et al. (2017) distinguish between processes, products, and outcomes/impacts and consider the reconfiguring of social practices to be the central process of SI (the initiating process by the innovators and early followers after a triggering event) while the emerging new networks, governance arrangements or attitudes as the products. Enhanced social, economic, or environmental wellbeing can be considered the impacts and outcomes of the SI (Secco et al., 2017). This tripartite subdivision of the contribution of SI to human lives is useful for the purpose of our study as it allows us to define and isolate the environmental-impact dimension of SI.

Third, this definition emphasizes the role of SI in transforming unmet needs of society into future opportunities for enhanced societal wellbeing. This is a relevant viewpoint as it characterizes SI as a phenomenon that emerges as a response to key necessities/opportunities not yet exploited (Neumeier, 2017). Shocks (e.g., earthquakes, floods, wildfires) and the consequences of climate change can thus be considered in many cases as the triggering factors of pro-environmental SI actions due to unmet socio-ecological needs (e.g., lack of security and normalcy due to wildfires occurrence; Górriz-Mifsud et al., 2019). Not all SIs start as bottom-up initiatives as they can also filter down from higher-level schemes or can be a combination of both bottom-up and top-down approaches. Good examples of multilevel initiatives are for instance the “Covenant of mayors” (Covenant of mayors, 2021) where communities are supported by the European Union to find local solutions to current climate change

issues, and the LEADER programme (ENRD, 2016) where the European Union supports rural development projects initiated at the local level to revitalize rural areas and create jobs.

Finally, in this paper we focus our analysis on European and circum-Mediterranean rural areas. SI is a phenomenon which has been relatively well studied in the urban environment (e.g., Moulaert et al., 2010), but not in rural areas. This is a relevant research gap especially for the environmental governance sphere, as often rural areas are places where the environment holds strongly in people imaginaries (Hinds & Sparks, 2008), and thus where environmental crises and shocks can act as powerful triggers for the emergence of SI.

1.2.2 | Sustainable Development Goals

The 2030 Agenda for Sustainable Development was adopted at the United Nations Sustainable Development Summit on 25 September 2015 and includes 17 Sustainable Development Goals (SDGs) and 169 related targets, which recommend action on various social and environmental issues (United Nations, 2015b). The Agenda applies to all countries and is now the major framework for guiding development policies and efforts across local to global scales (Katila et al., 2019). SDGs recognize that ending poverty and other deprivations must go hand in hand with strategies that improve health and education, reduce inequality, enhance economic growth through affordable and clean energy, promote innovation and enhance infrastructure, promote responsible consumption and production, while at the same time tackle climate change and preserve the ecological condition of aquatic and terrestrial ecosystems. SI is thus considered a key component in fulfilling the SDGs milestones by 2030 (Millard, 2018; Ravazzoli & Valero López, 2020).

Many international governance mechanisms (e.g., the European Union Bioeconomy Strategy) are aligned with the SDGs (Ludvig et al., 2019). It is thus logical to use them for operationalizing the analysis of the environmental impacts of SI initiatives, especially when the extent to which SI contributes to environmental-related outcomes is a rather unexplored field. Several studies have used the SDGs framework for assessing the positive role of SI in addressing socioeconomic challenges. Eichler and Schwarz (2019) carried out a review on which SDGs are addressed by SI initiatives. They showed that most of their examined SI case studies dealt with an improvement of human health and well-being. Flinzberger et al. (2020) carried out a Delphi study focused on which SDGs can be considered relevant for agroforestry systems, and how to translate them into suitable indicators for labeling agroforestry products. Katila et al. (2020) studied how the different aspects of land tenure rights are included and addressed by the SDGs and their specific targets. Secure rights to land and resources are a prerequisite for sustainable use of land and natural resources and are therefore essential for sustainable development.

These earlier results show that SI initiatives can have impacts (direct or indirect) on specific SDGs targets. Given the large number of SDGs and related targets, both synergic interactions and

trade-offs are inevitable. Kroll et al. (2019) found notable synergies across certain goals (e.g., SDG 13 Climate Action with SDG 11 and 6), and trade-offs for other goals, including a serious nonalignment between clean energy provision and poverty reduction. In contrast, the results from Hegre et al. (2020) based on global data 2000–2016 indicate that synergies between and within SDGs prevail. Scherer et al. (2018) observed that pursuing social goals is, generally, associated with higher environmental impacts. Entities developing SDGs-based strategies should thus acknowledge interactions across Goals, and their actions need to be designed reflecting upon the type and directionality of the interaction, its strength and certainty, and different context-based factors to assess whether certain degree of trade-offs are acceptable (Nilsson et al., 2016). SIs would inherently aim at (at least) maintaining or improving socioeconomic conditions—in addition—to leverage environmental problems, thus intuitively making the chances for trade-offs more unlikely. However, these trade-offs are not completely inexistent as social innovators (unless they are public entities) are generally driven by effectiveness, sustainability, and viability principles rather than policy coherence. Although acknowledging the existence of both trade-offs and synergies across SDGs, the focus of this paper is to identify whether SI, besides delivering intrinsic socioeconomic impacts, also fulfill a series of environmental impacts framed using the SDG nomenclature.

Finally, studying the role of SI models in delivering positive environmental impacts is also relevant in the field of ecosystem management. Rather than being static systems, ecosystems are constantly evolving and changing (Santamaría & Méndez, 2012). Modern ecosystem management theories have shifted their focus from attempting to maintain ecosystems in some fixed optimal state to guiding ecological change along desirable trajectories. Several published examples point to the key role that local collaborative and adaptive approaches play in comparison to sectoral expert-centred approaches in the field of ecosystem management (Biggs et al., 2010). Assessing the environmental impacts of SIs, can thus provide valuable insights on understanding the conditions and processes necessary to stimulate institutional transformation in ecosystem management in other areas and at larger scales.

2 | MATERIALS AND METHODS

2.1 | SI initiatives catalog

The SI initiatives analyzed in this study were drawn from a catalog of both local and international SI examples in the fields of forestry, agriculture, and rural development covering Europe and countries south and east of the Mediterranean. The examples were collected from a range of sources including academic literature and in consultation with academics and stakeholders and together form a key output of the SIMRA project: Catalog of Diversity of Social Innovation (Valero & Bryce, 2020). The catalog categorizes SI based on a range of variables

including the challenges addressed, sector, topic, institutional form, key partners, social practices, and resulting social change alongside geographical information. It contains over 400 initiatives of which 238 are validated SI examples according to the definition developed by SIMRA (Polman et al., 2017), and 23 were analyzed in the project as in-depth empirical case studies (agriculture: Baseline et al., 2021; forestry: Barlagne et al., 2021; Rural Development Perlik, 2021; Fisheries: Vassilopoulos et al., 2021). We used the 238 validated SI initiatives as our data set. The examples cover a rich diversity of SI: prominent topics of focus include social farming, provision of public services, valorization of traditional land management practices, entrepreneurship, and initiatives to support vulnerable groups. The catalog consists of descriptive narratives of the SI cases. These describe the objectives and outcomes of initiatives, where these are known, and refer to social, economic, cultural, and environmental impacts. We used these descriptive narratives to ascertain whether SI initiatives had resulted in environmental impacts and the nature of these impacts.

2.2 | Data collection and data processing

To classify the environmental impacts of selected SI initiatives through the SDGs framework, we used a tripartite methodology. Firstly, we identified what can be considered as an “environmental impact” in the frame of our study. Secondly, we identified which of the 169 SDGs targets contain a clear environmental component, according to step 1. Finally, we performed an expert evaluation of the case study catalog (2.1) with the aim of identifying their potential contribution to SDG environmental targets.

From an environmental viewpoint, we can categorize impacts of SI initiatives as: (i) those that target socioeconomic needs (decent jobs, livelihood strategies) and/or cultural aspects (heritage preservation); (ii) those that explicitly target environmental improvements. In the first category, the primary focus of SI initiatives is on socioeconomic aspects, but given they are based on sustainable use of natural resources (e.g., green transport systems for improving local economic development), they are associated with environmental-friendly practices (e.g., recycling). In the second category, environmental impacts are the primary focus of the SI and thus easier to identify.

To ascertain the environmental impacts of SI initiatives, we use the following definition of impact: “the changes which are expected to happen due to the implementation and application of a given SI initiative” (Secco et al., 2017). As follows, such changes might result in environmental, social, economic, or institutional impacts (Ravazzoli et al., 2021). From a socio-ecological perspective, our focus on environmental impacts refers to any change in the ecological subsystem related to the societal challenges addressed by the SI's activities, products, or services (e.g., Secco et al., 2017). While impacts can be both direct and indirect, we identified direct changes only, as they are clearly related to the SI activities and thus more accurately identifiable from available secondary data. Among such direct impacts we considered those that are generated by purposeful actions which are

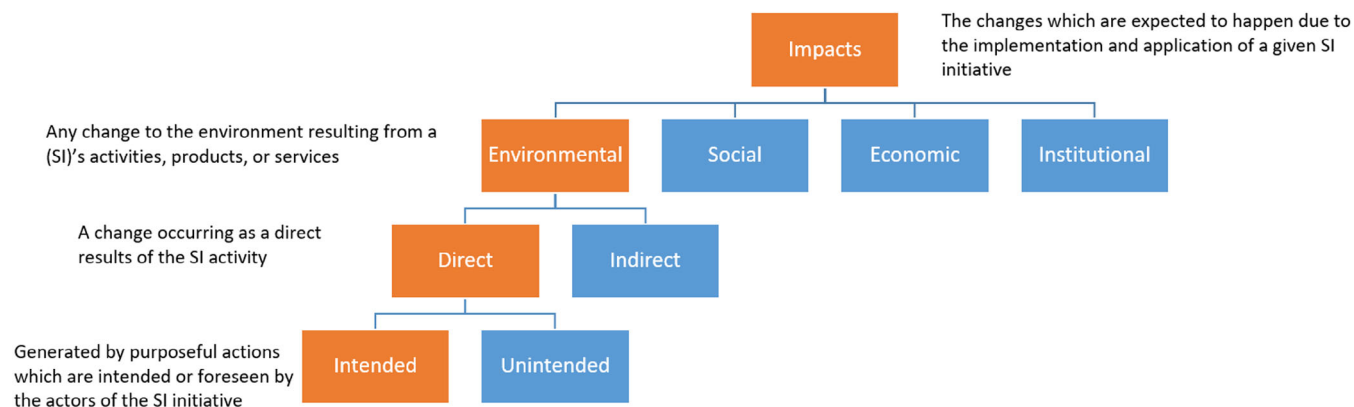


FIGURE 1 Hierarchical scheme of the impacts of SI. Orange boxes represent the categories considered in this study. Source: Own elaboration based on Secco et al. (2017) [Color figure can be viewed at wileyonlinelibrary.com]

intended or foreseen by the actors of the SI initiative, and not those that are unintended. Figure 1 provides a graphic hierarchical scheme showing the working definition of impacts in use in this study. In orange, we indicate the impacts considered.

Ravazzoli et al. (2019) identified the following environmental impacts of SI through empirical research: (i) reduced vulnerability to environmental risks (ii) enhanced wellbeing and human health, (iii) reduced ecological degradation of environmental assets, and (iv) enhanced socioeconomic value through the preservation and promotion of environmental assets. Given this assessment referred to a limited set of case studies, the current study uses a more objective protocol to categorize environmental impacts of SI: the SDGs framework. Our application differs to that used by Eichler and Schwarz (2019), where they looked at the relationship between SI and all SDGs. We focus only on goals strictly related to the environment, and their relative sub-targets. Although the 2030 SDGs Agenda includes 17 goals and 169 targets with a total of 247 indicators (United Nations, 2015b), we stay at the target level owing to the difficulties in compiling disaggregated environmental data at the administrative level in which most of our analysis falls. Almost half of the SDG targets require environmental statistics to be able to compile its indicators and enable regular monitoring of progress.¹

We reviewed all 169 SDGs targets, as they are presented in the *Global indicator framework for the Sustainable Development Goals and targets of the 2030 Agenda for Sustainable Development* (United Nations, 2020). The Environment Statistics Section of the United Nations (United Nations, 2016) categorizes the 17 SDGs into three groups: (a) those having a full environmental dimension (Goals 6, 7, 11, 12, 13, 14, and 15), (b) SDGs partially integrating the environment in some of their targets (Goals 2, 3, 8, 9), and (c) SDGs without a clear environmental component (Goals 1, 4, 5, 10, 16, 17). To validate this broad categorization, we closely scrutinized each SDGs target definition to determine whether the scope of the target included any direct environmental impact. Following this additional assessment, we selected a final list of 65 SDGs targets with an environmental dimension. This further classification excluded certain targets from group (a) (6.2, 6.a, 7.b, 11.1, 11.c, 12.1, 12.a), while include additional targets from group (c)

(1.4, 1.5 and 17.14). Appendix A lists the 65 selected targets identified in this study having a direct impact on the environment. These targets were used to classify the 238 SI initiatives of the catalog.

To identify the environmental impacts of the 238 SI initiatives, we performed an expert evaluation assessment based on the existing information available in the SIMRA catalog. We firstly identified whether each of the SI initiatives had any direct and intended environmental impacts through its activities. If so, we classified the SI environmental impact using a matrix of the 65 SDGs related targets. When the targets included several impact fields (e.g., the 1.4 SDG target, focusing on equal access to natural resources, but also on microfinance, and gender equality aspects), we made sure that we assessed the SI case exclusively on the environment dimension. When the SI initiative description did not offer sufficient information in the database, or in the external references provided (scientific publications, gray literature, SI initiative website) to be properly assessed, the SI initiative was excluded from the analysis (11 excluded). Similarly, when the SI initiative was assessed as not addressing any environmental target, it was also excluded from the analysis (57 excluded).

2.3 | Data analysis

To identify patterns across SI initiatives in relation to their environmental impacts, we performed a mixed qualitative and quantitative analysis. To tackle our first research question, we ran a series of descriptive univariate statistical analyses on the data set. Firstly, we computed the total number of SI initiatives covering at least one environmental SDG target, as well as the frequency of SDGs by cases. These descriptive analyses allowed us to identify which share of the sample has positive impacts on the environmental sphere, as well as to identify which are the most common environmental SDGs across our sample. In the second analysis, we assessed the cases by a series of descriptors (e.g., scale, sector, year of establishment), which allowed us to identify any relevant intra-case pattern. For our second research question, we used a dendrogram as a diagrammatic representation to identify groupings of CS based on similar environmental

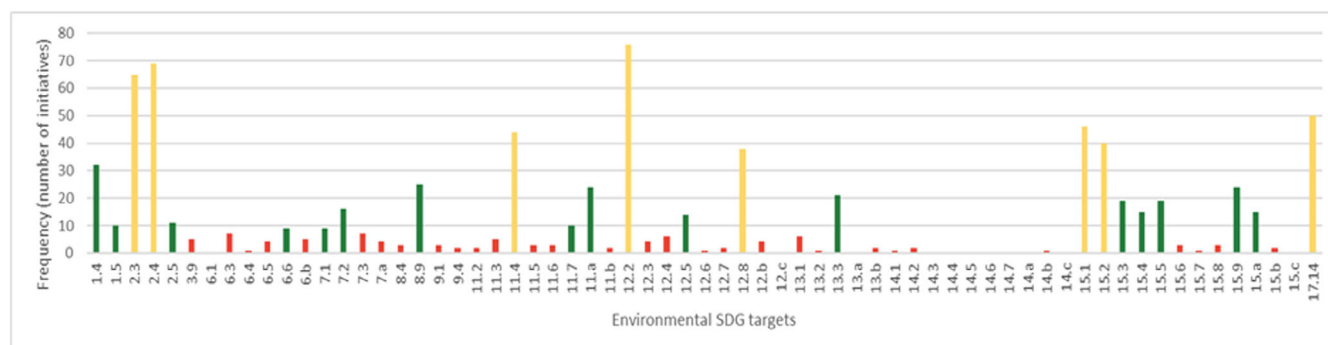


FIGURE 2 Frequency (in number of initiatives) of 65 environmental SDGs targets across a sample of 161 social innovation initiatives. Yellow bars indicate the most frequent targets (above 20%), while red bars indicate the least frequent targets (less than 10%) [Color figure can be viewed at wileyonlinelibrary.com]

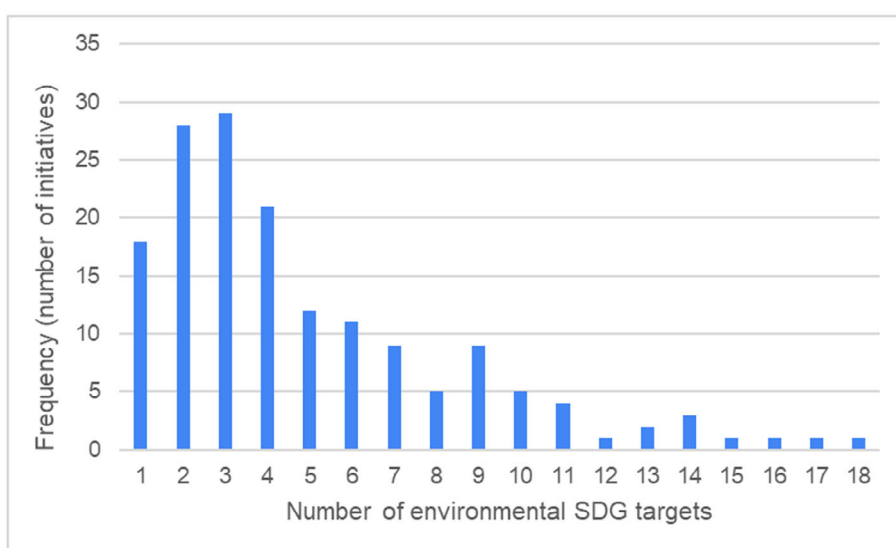


FIGURE 3 Frequency plot of 161 social innovation initiatives classified by the number of different environmental SDG targets they address simultaneously [Color figure can be viewed at wileyonlinelibrary.com]

SDGs patterns (Appendix B). The dendrogram was produced using Ward's method as a clustering criterion (Ward, 1963). By inspecting the dendrogram, we were able to identify nine grouping levels, which were further qualitatively classified by means of their most abundant environmental SDG targets. The dendrogram also allowed us to assess the consistency of such quantitative automatic classification. Through that, we were able to further identify nine initiatives which were wrongly assessed and thus removed from the sample, bringing the final data set to 161 observations. All quantitative analyses were performed in Excel and using the computing environment R (R Core Team, 2020).

3 | RESULTS

3.1 | Descriptive statistics

Of the 238 SI initiatives assessed, 68% appear to have one or more impacts of their activities linked to the environment, while

the remaining ones impact on other spheres (e.g., social inclusion of vulnerable groups, elderly care, art and culture preservation, etc.). Within the environmental sub-sample, the most common impacts are related to sustainable natural resource management (SDGs target 12.2; 47% of the SI initiatives with environmental impacts), sustainable food production systems (SDGs target 2.4; 43%), equal access to land (SDGs target 2.3; 40%), policy coherence for sustainable development (SDGs target 17.14; 31%), conservation restoration and sustainable use of Earth's ecosystems (SDGs target 15.1; 29%), protecting and safeguarding the world's natural heritage (SDGs target 11.4; 27%), sustainable forest management (SDGs target 15.2; 25%), and increasing environmental awareness (SDGs target 12.8; 24%) (Figure 2). Eleven SDGs targets were judged as having an environmental-oriented focus but were not present in the SI initiatives catalog. These include targets related to drinking water (6.1), fossil-fuel subsidies rationalization (12.c), climate change awareness (13.a), marine preservation (14.3, 14.4, 14.5, 14.6, 14.7, 14.a, 14.c), and combating species poaching and trafficking (15.c). Most of the SI environmental initiatives in the data set contribute to 2–3 SDG targets (35% of the overall cases; Figure 3). A

TABLE 1 161 social innovation initiatives classified by the number of SDG targets they address as well as their geographical scale, sector, and establishment date

Number of SDG targets	Geographical scale					Sector			Establishment date				
	%	Local	Regional	National	International	Agriculture	Forestry	Rural development	1971–1980	1981–1990	1991–2000	2001–2010	2011–2020
1–5	69	37%	15%	13%	2%	17%	11%	39%	1%	1%	8%	23%	32%
6–10	23	13%	5%	4%	2%	7%	4%	13%	0%	1%	4%	9%	12%
11–15	6	3%	3%	1%	1%	1%	3%	3%	0%	0%	0%	2%	5%
16–18	2	1%	0%	1%	0%	0%	1%	1%	1%	0%	0%	1%	1%

Note: Numbers in bold represent the most abundant categories for each class.

smaller number of initiatives (9%) contribute to a large spectrum of SDG targets (more than 10 targets).

Table 1 displays the SI initiatives categorized by number of SDG targets they address and their relative geographical scale, sector, and establishment date. This result shows that most of the SI initiatives of the study sample are local and established within the past ten years. This is an expected pattern, which reflects the initial composition of the sample. Interestingly, initiatives that address up to five SDG targets are mainly representative of the rural development sector (39%), followed by agricultural and forestry cases (17% and 11%, respectively). A small share of forestry and rural development SIs covers multiple SDG targets (3% impacting 11–15 SDG targets, and 1% impacting 16–18 targets for both sectors), with agriculture not being so multidimensional.

3.2 | Classification of SI initiatives into groups

The tree diagram classifying the SI initiatives into groups of similar environmental SDG targets, identified nine groups of SI initiatives with different environmental governance focus (Figure 4):

1. Group 1: **Increasing awareness for environmental protection**. This group includes 12 SI initiatives (7.5% of the total) addressing mostly SDG target 12.8, and less frequently 11.4 and 13.3.
2. Group 2: **Sustainable tourism for natural protection and coherent policy development**. This group has 12 initiatives (7.5%) covering 3.5 SDG targets in average and mainly 8.9, 11.4, and less frequently 17.14.
3. Group 3: **Sustainable and renewable energy**. With 12 initiatives (7.5%), an average of 3.9 SDGs targets per case and having as most frequent 7.1, 7.2, 7.3, and 17.14.
4. Group 4: **Sustainable food production models in agriculture**. This group has 16 initiatives (10%) 1.6 SDG targets in average covering mainly 2.3 and 2.4.
5. Group 5: **Waste reduction and recycling**. This group includes 8 initiatives (5%) addressing mainly the SDG targets 12.5. This group has an average of 1.8 targets per case.
6. Group 6: **Hubs and partnerships to improve sustainable territorial development**. This group (15 initiatives; 9%) focuses on SDG targets 1.4, 17.14, and less frequently 2.3. This group has an average of 2.3 targets per case.
7. Group 7: **Sustainable agriculture for a better management of natural resources and heritage**, with 33 initiatives (20.5%), an average of 4.9 targets per case, focusing on targets 2.3, 2.4, 12.2, and less frequently 11.4.
8. Group 8: **Sustainable forest management**. This group includes 19 initiatives (12%) addressing SDG targets 12.2, 15.2, and less frequently 15.1. It has an average of 3.8 targets per case.
9. Group 9 **Multi-targets initiatives**. This group includes 34 SI initiatives (21%), which cover multiple SDG targets, with an average of 12.7 targets per case.

Details of each group are presented in the next subsections and in Appendix C.

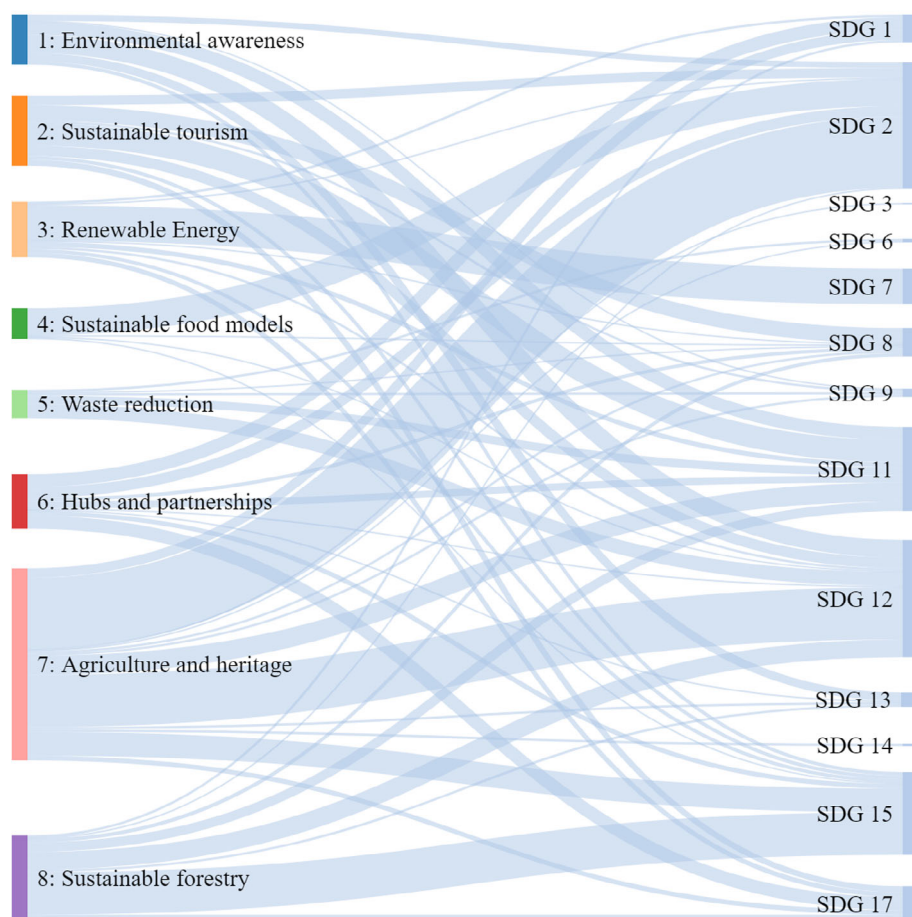


FIGURE 4 Sankey diagram showing the breakdown of the environmental impacts across the eight groups of SI initiatives by SDGs (Group 9 multi-SDG targets initiatives is excluded from the diagram) [Color figure can be viewed at wileyonlinelibrary.com]

3.2.1 | Increasing awareness for environmental protection

The SI initiatives of this group share a strong environmental awareness component focused on: (i) awareness raising activities for sustainable development (SDG 13—climate action; SDG 12—responsible consumption and production); (ii) improving awareness of natural and cultural landscape heritage preservation (SDG 11—sustainable cities and communities). Their overall aim is to reconcile society with nature through educational experiences, which can foster sustainable and traditional practices.

3.2.2 | Sustainable tourism for natural protection and coherent policy development

This group includes 12 initiatives, which focus primarily on two environmental axes: (i) promotion of sustainable touristic practices (SDG 8—Decent work and economic growth), (ii) strengthened efforts to safeguard natural heritage (SDG 11—Sustainable cities and communities). Their scope includes the promotion of alternative touristic habits and/or destinations harmonized with local natural capital, which can support local communities' development and preservation of local traditions.

3.2.3 | Sustainable and renewable energy

Twelve energy-related initiatives are included in this group, focusing on either supply of energy through direct installations or through mechanisms allowing access to renewable energy, like cooperatives, land ownership, third sector local development agencies. All energy sources were renewable (SDG 7—Affordable and clean energy) and nature-based with installations based on the following sources: (i) water/hydroelectric, (ii) forest biomass, (iii) wind, and (iv) mixed renewable sources. Policy adherence mechanisms or network development were only evident in a minority of cases (SDG target 17.14), and in one case the SI initiated to replace a policy failure. Sustainable use of resources (SDG 11) were linked to landscape approaches that included cultural heritage (SDG target 12.2).

3.2.4 | Sustainable food production models in agriculture

The SI initiatives in this group aim at achieving sustainable food production models in agriculture. Most of the SI are social farming and farming cooperatives tackling the social and economic aspects of organizing supply chains and enhancing human well-being. Reducing poverty and preventing social exclusion are important transversal and non-environmental themes in this group. The SI cases

in Group 4 are most frequently addressing environmental targets related to SDG target 2.3 (double the agricultural productivity and incomes of small-scale food producers), and SDG target 2.4 (ensure sustainable food production systems and implement resilient agricultural practices). Group 4 has much in common with Group 7 as most of the cases involve local, organic, and/or traditional agricultural products and aim to maintain attractive rural areas. However, the focus of Group 4 is on social and well-being outcomes (poverty reduction and social inclusion) along with sustainable food production models, while Group 7 has a more specific focus on conservation agriculture, sustainable land use, and sustainable use of natural resources.

3.2.5 | Waste reduction and recycling

This group includes 13 initiatives focusing on sustainable development practices through waste reduction, recycling, and increased efficiency. Most contribute to SDG 12.5—substantially reduce waste generation through prevention, reduction, recycling, and reuse.

3.2.6 | Hubs and partnerships to improve territorial development

This group compiles very heterogeneous initiatives, which range from local co-ops and social farms, to landscape and national-level approaches. These initiatives contain a relevant coordination component as they are either networks or umbrella platforms or represent a coalition between different agents. These SIs reflect alliances between actors of different sectors with a wider rural developmental vision than in the other groups (more sectorial-specific), contributing mainly to the SDG targets 1.4 and 17.14.

3.2.7 | Sustainable agriculture for management of natural resources and heritage

The SI initiatives in this group are aimed at sustainable agriculture through sustainable management of natural resources and restoring or preservation of cultural and natural heritage elements in rural landscapes. They are often social farming and farming cooperatives, or examples of community farming like those in Group 4, but with a more specific focus on environmental aspects, such as organic agriculture and environmental conservation.

3.2.8 | Sustainable forest management

Group 8 includes 19 SI initiatives aiming to improve forest management, through a diversified offer of services and products. Such initiatives mainly impact SDG 12 (12.2 on sustainable management and efficient use of natural resources) and SDG 15 (15.1 on sustainable use of terrestrial and inland freshwater ecosystems and 15.2 on

sustainable management of all types of forests), and to some extent SDG 11 (11.4 on the world's cultural and natural heritage). The initiatives usually target forest owners, through communal forests or cooperatives, although many other stakeholders are involved (policy makers, advisors, researchers, volunteers, etc.).

3.2.9 | Multi-SDG targets initiatives

This final group includes SI initiatives with a broad spectrum, which cover multiple SDG targets. These initiatives are usually structured as large regional or national associations or platforms, which focus on combined agro-forestry-development aspects. They tend to address safeguarding and management of sustainable food production models and natural ecosystems (SDG 15—Life on land; SDG 2—Zero hunger), but also focus on larger transversal targets of sustainable development (e.g., target 17.14).

4 | DISCUSSION

In this section, we firstly discuss the results focusing on the most/least frequent environmental governance fields impacted by the grassroots SI initiatives. We then examine our findings in the light of the current global transition toward a green economy and consider the extent to which SI can contribute to global environmental targets as those highlighted by the SDGs. Finally, we present the limitation of our assessment and some final recommendations.

4.1 | Environmental impacts of SI initiatives

Our results indicate that SI initiatives constitute a set of novel governance arrangements that tackle environmental challenges at the local level, promoting new ways of doing things through collective actions and networks, which facilitate greener behavioral models. This finding has been highlighted by other scholars, who showed the importance of the environmental dimension for many SI initiatives (Pol & Ville, 2009; Ravazzoli et al., 2019; Vercher et al., 2020). The three most frequent environmental SDGs identified in our sample (SDG targets 12.2, 2.4, and 2.3) are intertwined with relevant societal needs of rural areas. (i) Fostering sustainable resource management links to key socioeconomic needs for the revitalization of rural areas (Yin et al., 2019), as well as new forms of managing natural resources based on collective activities (Pretty, 2003). (ii) Innovative environmental-friendly production models often foster fairer economic markers for empowering vulnerable or disadvantaged groups of society (Tulla et al., 2017). (iii) Equal access to land, directly relates to securing property rights of individuals and poverty alleviation (Oates et al., 2020). All such socio-ecological challenges are of paramount importance for the global policy agenda, as highlighted by, for example, the Rio Declaration on Environment and Development (Agenda 21) adopted in 1992, which called for a tighter inclusion of local communities for local sustainable development (United Nations, 1992). Beside the abovementioned synergies, trade-

offs, can also emerge, as frictions between contrasting goals and targets. Trade-offs can be more prominent in cases where fewer SDGs impacts have been identified counteracting the impacts on other SDGs. We argue that the likelihood that the SI promoters overlooked negative social-economic-environmental interactions at a local level is limited, as this would be detrimental for the SI emergence and establishment, due to the limited number of beneficiaries in rural settings. Additionally, we believe that innovators initiating environmental SI initiatives, tend to seek and establish synergies with certain socioeconomic impacts linked to the main context-based issues of the rural area where the initiative operates (e.g., depopulation, lack of services, limited transports, lack of economic opportunities for youth, etc.). If trade-offs do become evident, they should be assessed at a regional or national level, as to measure any aggregated and considerable negative interactions across Goals (Nilsson et al., 2016).

From our results, we can also see that SI initiatives tend to focus on one to three environmental targets. This suggests that SI initiatives, as locally grounded schemes, are often centered around few specific needs, which a group of actors seeks to fulfill through changed social practices (Dalla Torre et al., 2020). Yet, most of the analyzed SIs contribute to more than one objective. This could be explained by the fact that people in rural areas often face simultaneously different environmental challenges. Since rural areas are sparsely populated, it is more efficient for SI actors to coordinate local initiatives towards improving collective well-being in various directions. This is usually done by either combining environmental impacts with socioeconomic outcomes, or by consolidating different environmental targets into one common vision. SI thus appears as a useful instrument for improving coherence across different policy fields (e.g., Nilsson et al., 2012). Our findings also indicate that SIs may enhance bridging social capital by interconnecting local SI initiatives through larger-scale networks (e.g., Groups 6 and 7). Besides its potential advocacy role, this networking level facilitates out- and up-scaling,² thus supporting transformative and incremental innovations (Biggs et al., 2010). Bridging social capital also fosters adaptability of socio-ecological systems by providing a continuous innovation flows, tackling both societal and environmental challenges (Baker & Mehmood, 2015). We also identified that SI cases characterized by large regional or national associations or platforms (Group 9) address more than one SDG environmental target. This can be linked to the fact that they tend to have a policy-coherent vision, since many of the actors in the core group have links to policy development. On the contrary, small, bottom-up, and local initiatives, tend to emerge in relation to specific context-based objectives (e.g., requirement for a recycling scheme) and do not necessarily have immediate synergies with other SDGs. This, however, is not a shortcoming but rather an intrinsic characteristic of many SI models in rural areas, which often evolve and diversify over time forming synergistic relationships with other initiatives to address multiple goals. The role of orchestrating policies become thus extremely relevant promoting policy measures which can support constellation of diverse local SIs to improve their coherence at national level (Slee & Mosdale, 2020).

Complementing Eichler and Schwarz (2019), our results prove the relevant contribution of SI to the environmental SDG targets—at least in the analyzed rural areas. Yet, we also identified a series of

environmental gaps, not covered by the SI catalog. We related this finding to two main factors: (i) inherent limitation of our sample, which focuses exclusively on rural challenges for European and circum-Mediterranean countries (e.g., SI cases in the marine context are scarce, and where drinkable water or poaching constitute less problematic challenges than in other global regions); and (ii) the local level of most SIs in the sample. This latter point precludes the studied cases to achieve environmental SDG targets which can be tackled only at larger international and institutional level (such as the target 12.c on fossil-fuel subsidies rationalization).

Finally, our findings also show that rural development and forestry-based SI initiatives appear to tackle multiple environmental aspects through the same project. This contrasts with SI agricultural initiatives, which tends to be narrower in their scope. This might be related to the fact that rural development initiatives often act at landscape level, and thus involve multiple user-groups and have environmental needs to fulfill (e.g., from natural heritage to recycling). The scope of forestry SI initiatives is instead gradually converging toward forest multifunctionality and ecosystem services approaches; a diversification of the sector that provides opportunities for the current bio-economy transition (Ludvig et al., 2019; Melnykovich et al., 2018).

Our study uses the SDG classification to assess the environmental impacts of various SI initiatives, proving to be a useful analytical tool for categorizing environmental impacts of policy relevance at international level. However, this approach has several limitations. First, the catalog of initiatives is not statistically representative of the population of interest, with probable overrepresentation of specific sectors. This is common in exploratory studies of this nature. Therefore, our results should be read as purely descriptive. Second, when classifying the SI initiatives, we relied heavily on secondary information retrieved through web-searches. However, SIs are often local and do not necessarily have the capabilities of developing fully informative web interfaces. This limited availability of information can affect the overall assessment (e.g., mixing impacts with desired objectives).

4.2 | Social innovations: Promising governance mechanisms for a green transition

SI models promote concerted actions that pursue a shared vision—a key element of cognitive social capital (Nahapiet & Ghoshal, 1998). Cognitive social capital, jointly with shared interpretations and narratives, predisposes people to mutually beneficial collective actions (Górriz-Mifsud et al., 2016). The creation of such shared visions can help in ground-setting new social paradigms leading toward greener societal models. SI can thus instill new development pathways for a place-based environmental governance (Baker & Mehmood, 2015), where environmental changes and social processes are mutually treated acknowledging their intrinsic feedback loops. If the policy framework recognizes that systematic changes can only be obtained with synergic top-down (i.e., overarching policy frameworks such as the SDGs; national and EU bioeconomy strategies, the 1992 Convention on Biological Diversity)

and bottom-up approaches, (Baker & Eckerberg, 2008), then SI emerges as a significant tool. SI can support new partnerships that can tackle local needs through the lens of societal challenges in the global Anthropocene (Frantzeskaki & Rok, 2018).

In our review, we identified how for instance the SIs of Groups 4 and 7 contribute to the “Farm to Fork strategy,” an important pillar of the EU Green Deal, seeking to transform the sustainability of food value chains (European Commission, 2020a). SIs contribute by making agricultural supply chains shorter, ensuring a fair economic return in the supply chain while at the same time improving human well-being by enhancing the social inclusion of marginalized and minority groups. Moreover, innovation cases of Group 7 would also contribute to the EU Biodiversity Strategy (European Commission, 2020b), by enhancing the sustainability of agriculture by reducing pesticides and halting biodiversity loss, among other practices. Along these lines, Group 8 plays a relevant role for operationalizing and modulating on-the-ground national and European Bioeconomy Strategies and the European Forest Strategy. This is done through small-scale viable value chains via participative mechanisms (e.g., forest owners' platforms and associations) and diversifying the services of the forestry sector (Barlagne et al., 2021; Ludvig et al., 2019). Moreover, SIs in marginalized and rural areas may contribute to enhance socio-ecological resilience in landscapes, bridging forest management with rural development activities and thus contributing to reducing land abandonment and natural hazards such as forest fires, and erosion (Rodríguez Fernández-Blanco et al., 2022). Climate change is affecting all sectors in society and the importance of adaptation to its impacts is recognized globally (European Commission, 2021). Due to a strong focus on nature-based solutions, disaster risk prevention, and social, environmental and cultural benefits, SIs in all groups can contribute to the EU strategy on Adaptation to Climate Change.

The acceleration of global changes is challenging planetary resilience. The EEA (2015) defines these interdependent negative changes as “global megatrends,” highlighting their large-scale, high impact, and inherent transversality and interdependency across sectors and societies (e.g., urbanization, growing pressure on ecosystems, diverging population trends, etc.). While this global-to-European vision is useful for environmental policy makers, in the recognition of intrinsic relationships between otherwise dissimilar processes (e.g., rural depopulation and increasing wildfire risk; Tedim et al., 2016) so that appropriate funding can be injected through overarching financing schemes (e.g., the European Green Deal aiming at transforming Europe into a “resource-efficient and competitive economy” by 2050; European Commission, 2020c), the need for actions exists at all scales, above all at the local level. SI can provide the proper tool to initiate a new approach favorable to rural development (Slee et al., 2018). Our results showcase that 71% of the 238 SI initiatives assessed, across Europe and circum Mediterranean countries have a variety of positive environmental impacts on local territories. Although such impacts are localized, they can be quantified through targeted assessment tools (i.e., the SIMRA Evaluation manual to assess SI; Secco et al., 2020), as to assimilate them to national quantitative targets or international frameworks such as the SDGs.

5 | CONCLUSIONS

The aims of this study were to identify the main environmental impacts of SI initiatives and explore the role of SI in contributing toward a green transition. We can conclude that:

- Addressing environmental challenges is a common focus within the rural SI initiatives assessed, combined with social, economic, and institutional needs. In particular, we identified nine groups of SI tackling different environmental governance fields.
- We recognized the functional role of SI as a novel governance mechanism contributing towards achieving the environmental SDGs, thus setting in motion a transition towards a greener world. With a favorable policy framework, SI can play synergistically with top-down legislative frameworks to overcome global climate change and environmental degradation challenges.

It is, therefore, possible to conclude that this study provides a basis to study in a systematic way the contribution of SI to environmental challenges. Further research is needed to expand these results to improve statistical robustness, as well as incorporating in-depth case-study empirical data into the assessment.

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ENDNOTES

- ¹ The existing Framework for the Development of Environment Statistics (FDES), its Basic Set of Environment Statistics (BSES), and the Environment Statistics Self-Assessment Tool (ESSAT) (United Nations, 2016) are the most widely used tools for developing environment statistics at national level. However, such tools have been disregarded as the macro-statistics that they provide cannot support in assessing the environmental-related impacts of SI initiatives with local/regional level.
- ² Scale Up: “Changing institutions including policy rules and laws”; Scale Out: replicating and disseminating the model, with “increasing number of people or communities impacted” (Moore et al., 2015).

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APPENDIX A

List of the selected SDGs with environmental dimension which were used for the assessment of the SI case-studies. The keywords related to the environmental component is highlighted in bold.

1.4 By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, **ownership and control over land** and other forms of property, inheritance, **natural resources**, appropriate new technology and financial services, including microfinance.

1.5 By 2030, build the resilience of the poor and those in vulnerable situations and reduce their **exposure and vulnerability to climate-related extreme events** and other economic, social and **environmental shocks, and disasters**.

2.3 By 2030, **double the agricultural productivity** and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment.

2.4 By 2030, ensure **sustainable food production systems** and implement **resilient agricultural practices** that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality.

2.5 By 2020, maintain the **genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species**, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed.

3.9 By 2030, substantially reduce the number of deaths and illnesses from **hazardous chemicals and air, water and soil pollution, and contamination**.

6.1 By 2030, achieve universal and equitable **access to safe and affordable drinking water** for all.

6.3 By 2030, improve **water quality** by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

6.4 By 2030, substantially increase **water-use efficiency** across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity.

6.5 By 2030, implement **integrated water resources management** at all levels, including through transboundary cooperation as appropriate.

6.6 By 2020, protect and restore **water-related ecosystems**, including mountains, forests, wetlands, rivers, aquifers, and lakes.

6.b Support and strengthen the participation of local communities in improving **water and sanitation management**.

7.1 By 2030, ensure universal access to affordable, reliable, and modern **energy services**.

7.2 By 2030, increase substantially the **share of renewable energy** in the global energy mix.

7.3 By 2030, double the global rate of improvement in **energy efficiency**.

7.a By 2030, enhance international cooperation to facilitate access to **clean energy research and technology**, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology.

8.4 Improve progressively, through 2030, **global resource efficiency in consumption and production** and endeavor to decouple economic growth from environmental degradation, in accordance with the 10 Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead.

8.9 By 2030, devise and implement policies to promote **sustainable tourism** that creates jobs and promotes local culture and products.

9.1 Develop **quality, reliable, sustainable and resilient infrastructure**, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all.

9.4 By 2030, upgrade infrastructure and retrofit **industries** to make them **sustainable**, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities.

11.2 By 2030, provide access to safe, affordable, accessible, and **sustainable transport systems** for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities, and older persons.

11.3 By 2030, enhance inclusive and **sustainable urbanization** and capacity for participatory, integrated and sustainable human settlement planning and management in all countries.

11.4 Strengthen efforts to protect and safeguard the **world's** cultural and **natural heritage**.

11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by **disasters**, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.

11.6 By 2030, reduce the adverse per capita **environmental impact of cities**, including by paying special attention to air quality and municipal and other waste management.

11.7 By 2030, provide universal access to safe, inclusive and accessible, **green and public spaces**, in particular for women and children, older persons and persons with disabilities.

11.a Support positive economic, social and environmental **links between urban, peri-urban and rural areas** by strengthening national and regional development planning.

11.b By 2020, substantially increase the number of **cities and human settlements** adopting and implementing integrated policies and plans towards inclusion, **resource efficiency, mitigation and adaptation to climate change, resilience to disasters**, and development and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels.

12.2 By 2030, achieve the **sustainable management and efficient use of natural resources**.

12.3 By 2030, halve per capita global **food waste** at the retail and consumer levels and reduce **food losses** along production and supply chains, including post-harvest losses.

12.4 By 2020, achieve the **environmentally sound management of chemicals and all wastes** throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment.

12.5 By 2030, substantially **reduce waste generation** through prevention, reduction, recycling and reuse.

12.6 Encourage **companies**, especially large and transnational companies, to adopt **sustainable practices** and to integrate sustainability information into their reporting cycle.

12.7 Promote **public procurement** practices that are **sustainable**, in accordance with national policies and priorities.

12.8 By 2030, ensure that people everywhere have the relevant information and **awareness for sustainable development** and lifestyles in harmony with nature.

12.b Develop and implement tools to monitor sustainable development impacts for **sustainable tourism** that creates jobs and promotes local culture and products.

12.c **Rationalize** inefficient **fossil-fuel subsidies** that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities.

13.1 Strengthen **resilience and adaptive capacity to climate-related hazards and natural disasters** in all countries.

13.2 Integrate **climate change measures** into national policies, strategies, and planning.

13.3 Improve education, **awareness-raising** and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.

13.a Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the **Green Climate Fund** through its capitalization as soon as possible.

13.b Promote mechanisms for raising capacity for effective **climate change-related planning and management** in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities.

14.1 By 2025, prevent and significantly **reduce marine pollution** of all kinds, in particular from land-based activities, including marine debris and nutrient pollution.

14.2 By 2020, sustainably **manage and protect marine and coastal ecosystems** to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans.

14.3 Minimize and address the impacts of **ocean acidification**, including through enhanced scientific cooperation at all levels.

14.4 By 2020, effectively regulate harvesting and end **overfishing, illegal, unreported, and unregulated fishing and destructive fishing practices** and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics.

14.5 By 2020, conserve at least 10% of **coastal and marine areas**, consistent with national and international law and based on the best available scientific information.

14.6 By 2020, prohibit certain forms of **fisheries subsidies** which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation³.

14.7 By 2030, increase the economic benefits to small island developing States and least developed countries from the **sustainable use of marine resources**, including through sustainable management of fisheries, aquaculture and tourism.

14.a Increase scientific knowledge, develop research capacity and transfer **marine technology**, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries.

14.b Provide access for **small-scale artisanal fishers** to marine resources and markets.

14.c Enhance the conservation and **sustainable use of oceans** and their resources by implementing international law as reflected in

the United Nations Convention on the Law of the Sea, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of “The future we want.”

15.1 By 2020, ensure the conservation, restoration and **sustainable use of terrestrial and inland freshwater ecosystems** and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements.

15.2 By 2020, promote the implementation of **sustainable management of all types of forests**, halt deforestation, restore degraded forests, and substantially increase afforestation and reforestation globally.

15.3 By 2030, **combat desertification**, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world.

15.4 By 2030, ensure the **conservation of mountain ecosystems**, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development.

15.5 Take urgent and significant action to **reduce the degradation of natural habitats**, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species.

15.6 Promote fair and equitable sharing of the benefits arising from the **utilization of genetic resources** and promote appropriate access to such resources, as internationally agreed.

15.7 Take urgent action to **end poaching and trafficking of protected species** of flora and fauna and address both demand and supply of illegal wildlife products.

15.8 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of **invasive alien species** on land and water ecosystems and control or eradicate the priority species.

15.9 By 2020, integrate **ecosystem and biodiversity values** into national and local planning, development processes, poverty reduction strategies, and accounts.

15.a Mobilize and significantly increase financial resources from all sources to **conserve and sustainably use biodiversity and ecosystems**.

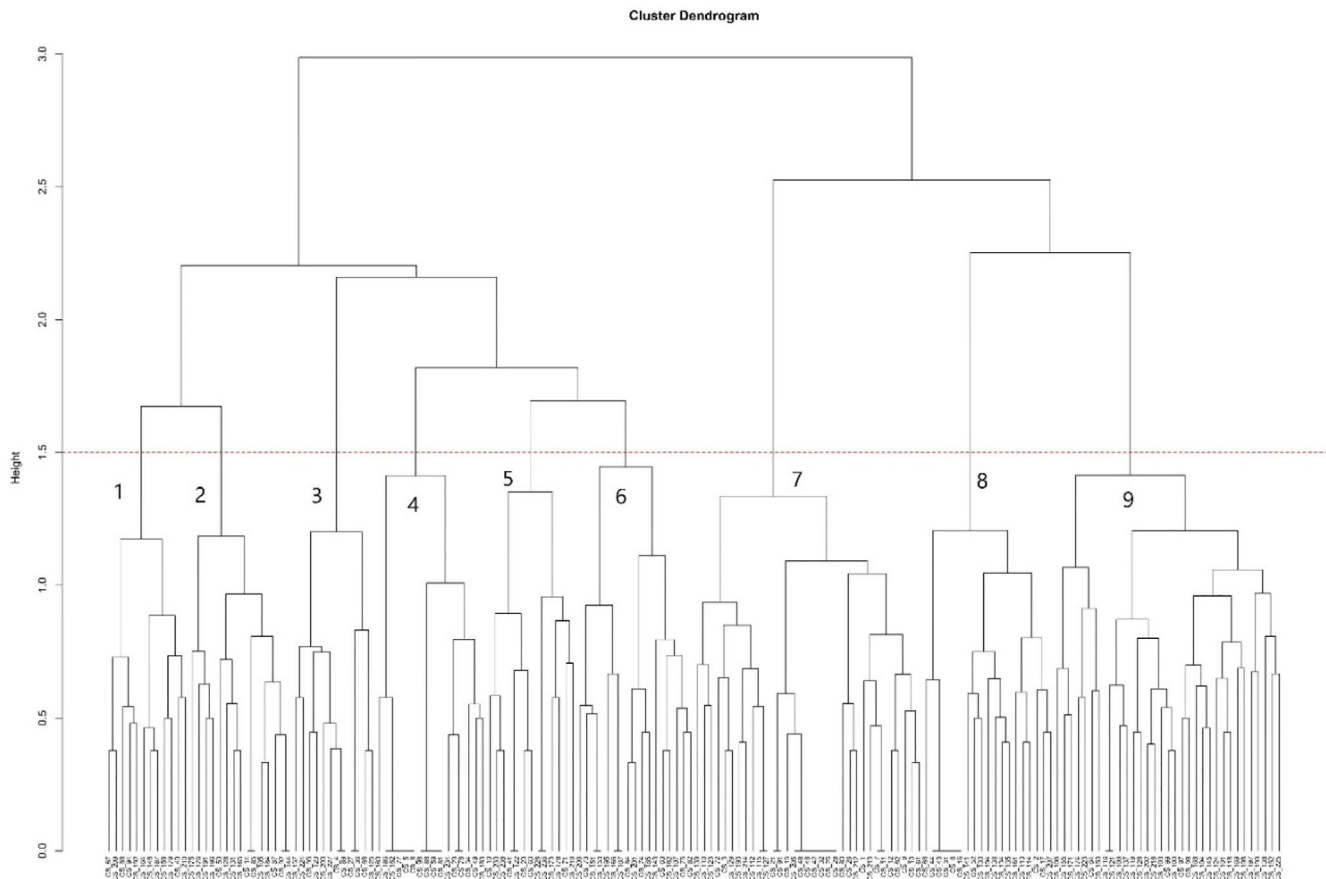
15.b Mobilize significant resources from all sources and at all levels to finance **sustainable forest management** and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation.

15.c Enhance global support for efforts to **combat poaching and trafficking of protected species**, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities.

17.14 Enhance policy coherence for sustainable development.

APPENDIX B

Dendrogram of 170 SI initiatives classified according to 65 environmental SDG targets. A height of 1.5 (dotted line) was selected to partition the sample into nine groups (indicated by the black numbers), with similar environmental patterns. After inspecting the dendrogram results, nine initiatives were identified as wrongly assessed and thus removed from the sample, bringing the final data set to 161 observations.



APPENDIX C

Additional description of the nine identified SI groups with examples from the SIMRA SI catalog. The SI initiatives are indicated with their corresponding name as they appear in the SIMRA catalog of cases in *italics*, followed by the location (Alpha-2 country code), if not reported in the SI name. INT indicates that the SI initiative operates at an international level.

1. Increasing awareness for environmental protection

Initiatives in this group target children and young individuals (e.g., outdoor schools for children: *Educare all'aria aperta*, IT), while others target vulnerable groups (e.g., prisoners from juvenile prisons, students dropping out of school and children with disabilities: *Tășuleasa Social association*; RO). Three types of SI initiatives can be identified in this group: (i) initiatives organized into structured educational programs (e.g., nature schools), (ii) awareness-raising initiatives aiming at providing to beneficiaries an overview of existing and yet forgotten traditional practices for enhancing the preservation of natural and cultural heritage at landscape level (e.g., alpine farming: *Team Karwendel*, AT; restoration and renovation of traditional buildings: *Recartografia*, ES; traditional shepherding: *Escola de pastores*, ES), (iii) awareness-raising initiatives aimed at fostering responsible consumption and production practices (e.g., organic farming and fair trade: *Gwad' Amap—Dot Soley*, FR). In some specific cases, these initiatives have been organized to protest against large industrial scale projects (*Noidanlukko*, FI), or can take the format of co-working space for peri-urban knowledge exchange (*Rural HUB*, RS). Overall, the initiatives within this group strongly rely on volunteers.

2. Sustainable tourism for natural protection and coherent policy development

Some of the Group 2 initiatives focus on promoting new means of travel (e.g., hiking or biking trails: *Hiking Routes in Balaton Uplands*, HU; *Mezőcsát*, HU). Others developed new integrated approaches to tourism which can enhance cooperation between public and private actors (*Italy Heartland*, IT; or the scattered hotel model developed in *Vrbanj*, HR) to increase local or regional coherence towards sustainable development. Finally, some initiatives integrate sustainable tourism practices (e.g., hikes) with local history and tradition and cultural heritage to boost the socio-economy of local communities (*Nallihan Tourism Volunteers Association*, TR; *Masar Ibrahim Al-Khalil*; PS).

3. Sustainable and renewable energy

Twelve energy-related initiatives are included in this group, focusing on either supply of energy through direct installations (e.g., *Udny Community Trust Community Wind Turbine*, UK) or through mechanisms allowing

access to renewable energy, like cooperatives (e.g., *Som Energia*, ES), land ownership (e.g., *North West Mull Community Woodland Company*, UK), third sector local development agencies (e.g., *Huntly Development Trust*, UK). All energy sources were renewable (SDG 7—Affordable and clean energy) and nature-based with installations based on the following sources: (i) water/hydroelectric, (ii) forest biomass, (iii) wind, and (iv) mixed renewable sources (e.g., *Local green energy initiatives in The Netherlands*). Seven cooperative-focused SI showed clear links to renewable energy (SDG 7) regardless of the source, however with clear place-based motivations such as bringing energy to remote places such as UK islands (e.g., “ACCESS: Assisting Communities to Connect to Electric Sustainable Sources,” UK; wind turbine installation on the Isle of Mull) and buffering shortages (due to, e.g., insufficient infrastructure, peaks in demand, need for energy independence due to available natural resources, e.g., *Bio-energy production by farmers*, AT). Indirect goals aim at reducing energy poverty and fossil fuel dependence. Policy adherence mechanisms or network development were only evident in a minority of cases (SDG target 17.14), and in one case the SI initiated to replace a policy failure. Sustainable use of resources (SDG 11) were linked to landscape approaches that included cultural heritage (SDG target 12.2).

4. Sustainable food production models in agriculture

The SI initiatives in Group 4 can be approximately divided into two types (i) social farming initiatives aimed at integrating people with a risk of social exclusion such as disabled people (*Agricoltura Capodarco Società Cooperativa Sociale*, IT), prisoners (*Gorgona Agricultural Penal Colony*, IT), and groups of different gender, age, ethnic, or religious background (*Riuverd*, ES; *Adelwöhrerhof*, AT), and (ii) cooperatives aimed at improving cooperation in rural communities in organizing agricultural supply chains. Very often these include community farming initiatives (*Gela Ochsenherz*, AT) short supply chains (*Del Monte de Tabuyo*, ES) and/or initiatives promoting contact between primary producers and local/urban consumers (*HAWARU Hof-Solidarische Landwirtschaft*, AT; *Fruit Tree adoption Tarlamvar*, TR).

5. Waste reduction and recycling

For some initiatives such as the *Call of the Earth community recycling Scheme* (LB), the primary objective was to implement a system of recycling where no such service existed. The *CAUTO social cooperative* (IT) works with supermarkets to reduce waste by redistributing unsold food for human or animal nutrition. In some cases, recycling is one component of broader participatory community development projects such as the *Lika womens' social cooperative* (HR) where participants create products from recycled materials. Other initiatives provide indirect environmental benefit—for example, *VISP* (AT) offers unemployed people the opportunity to reintegrate into the labor market through partnerships between social enterprise and the waste management sector where participants can be trained in new skills that have an environmental benefit. The remaining schemes relate to sustainable mobility,

for example, *Zdrav Šolar* (SI) provides more sustainable school transport options for children, that is, walking and cycling routes and *TALENTE-mobil* (AT) promotes pooling of private transportation reducing car use.

6. Hubs and partnerships to improve territorial development

This group compiles very heterogeneous initiatives, which range from local co-ops and social farms, to landscape (*French forest territorial charters*) and national-level approaches (the Austrian *Green Care*, or the Moroccan *Participatory agrolabel*). These initiatives contain a relevant coordination component as they are either networks or umbrella platforms (e.g., *Forum Nazionale d'Agricoltura Sociale*, IT, or the *Rural Development Network of Montenegro*), or represent a coalition between different agents (public and private actors—e.g., *dairy producer co-ops*, TN; or farmers with agrofood companies—e.g., the *Skylark Foundation*, NL). These SIs reflect alliances between actors of different sectors with a wider rural developmental vision than in the other groups (more sectorial-specific), contributing mainly to the SDG targets 1.4 and 17.14. Some of these initiatives directly manage natural resources as primary production, relying on the potential of nature-based activities as therapy/empowerment, inclusion, and livelihood source. Some of these networks aim at facilitating agroecology through alternative certification systems—for example, *Participatory Guarantee System* (INT)—that are more accessible to farmers than mainstream third-party labels. This group then contributes less frequently to SDG targets 2.3 and 2.4. The economic component is a commonality across the initiatives in this group—that is, selling products makes the initiative economically viable or the initiative reduces household expenditures (e.g., *Näh and Reparatur Café*, AT), which is intertwined with other welfare objectives—for example, improved women economic independence in the Lebanese co-op *Jana Al-Ayadi*, mental care in the Czech *Freedom Farm in the Confluence*, reduction of discrimination in the Serbian *Optimist association*, compatibility of forest uses in the French territorial charters, refugee integration in the Italian *Rise Hub*, or strengthened rural employment in the Swiss *Reseau de Fleurons*.

7. Sustainable agriculture for management of natural resources and heritage

Many of the initiatives aim to restore degraded landscapes (*Mazi farm*, GR) recover abandoned agricultural areas (*Adotta un terrazzamento*, IT), enhance (agro-)biodiversity in degraded landscapes (*Acacias for all*, TN) and restore cultural or natural heritage elements in the landscapes (*TERRAVIVA*, IT). Some of the cases also try to enhance rural tourism

(*Apadrina un Olivo*, ES), and very often this goes hand in hand with initiatives that are restoring cultural or natural heritage sites or promoting local and traditional food (*ASAT partnerships*, RO). The SI initiatives in this Group 7 differ from Group 4 as these address additionally targets 11.4 (strengthen efforts to protect and safeguard the world's cultural and natural heritage) and 12.2 (sustainable management and efficient use of natural resources). This group also includes cases of networks (*Terra Madre*, IT), online platforms (*Good4Trust*, TR; *Apiform beekeeping*, BA) and crowd funding initiatives (*Blue bees*, FR) that share similar aims, that is, improving the environmental farming sustainability, promoting biodiversity, connecting responsible producers, or restoring rural cultural and natural heritage elements.

8. Sustainable forest management

The SIs of this group include six main types of initiatives: (i) restoration of abandoned forests or ancient practices, for example, charcoal burning, enhancing the preservation of natural and cultural heritage (*Llais y Goedwig*, UK; *Montes de Socios*, ES; *Oglarska dežela*, SI), (ii) knowledge sharing and capacity building on skills to empower the community (e.g., unemployed youth or other vulnerable groups) and its wellbeing (*S4RE*, XK), (iii) valorisation and diversification of Non-Wood Forest Product (berries, mushrooms, medicinal plants, cork, laurel; *ARDAC*, LB), payment for ecosystem services and tourism, enhancing the economy through new value chains and microenterprises (*ADM market development*, TN; *Laggan Forest Trust*, UK; *LAMO*, IT; *S4RE*, XK), (iv) improving the resilience of forests to disturbances (winds, pests, fires) through communication to practitioners (*Associació de Gestors Forestals de les Gavarres*, ES) or Climate-Smart Forestry practices (*Carbon smart forestry in self-organized forest commons regime*, SK; *ENERBOSC*, ES), (v) education through forest schools (*Abriachan Forest Trust*, UK), and (vi) digitalization of forest management (*My forest mobile cooperative*, SI).

9. Multi-SDG targets initiatives

Examples of this group include: (i) landscape-based platforms for setting up participatory and voluntary agreements for managing natural resources (*Improving Lebanese forests areas' governance through the implementation of participatory approaches*; *Land Stewardship Networks*, ES; *Plataforma Forestal Valenciana*, ES), (ii) transnational cooperation projects for knowledge sharing (*Lebensqualität durch Nähe*, INT; *Inclu-far*, INT).